Electronic Supplementary Material (ESI) for RSC Advances.

Preparation of eco-friendly water-borne polyurethane elastomer with mechanical robustness and self-healable ability based on multi-dynamic interactions

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Table S1 Particle size and Zeta potential of IP-DAP$_x$-BA$_y$-WPU emulsions

Samples	Z-Average Size (nm)	Zeta Potential (mV)
IP-DAP$_{50}$-BA$_0$-WPU	29.46±0.470	-37.5±2.8
IP-DAP$_{45}$-BA$_5$-WPU	30.32±0.094	-40.0±3.2
IP-DAP$_{40}$-BA$_{10}$-WPU	30.77±0.334	-39.6±2.4
IP-DAP$_{35}$-BA$_{15}$-WPU	32.47±0.642	-49.1±1.6
IP-DAP$_{30}$-BA$_{20}$-WPU	44.71±0.356	-38.2±1.7
IP-DAP$_{25}$-BA$_{25}$-WPU	50.92±1.044	-35.7±2.9

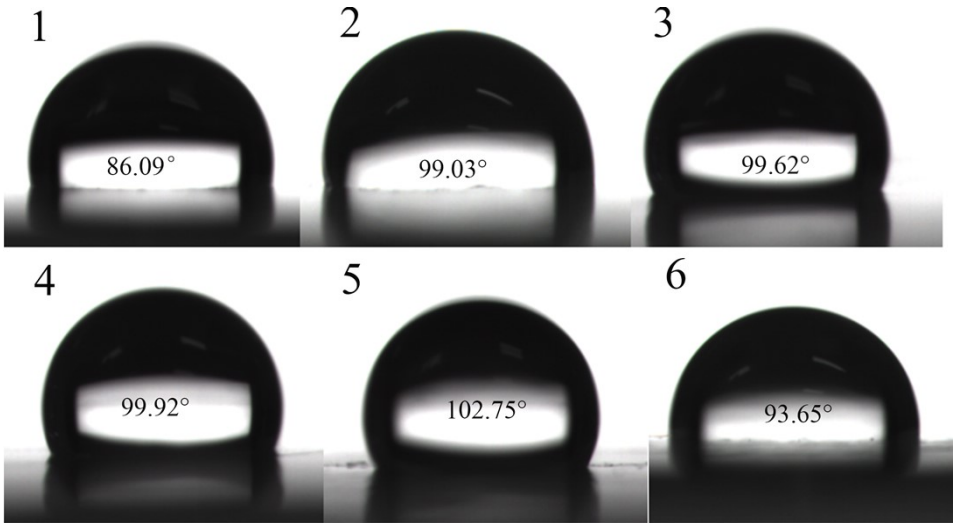

Fig. S1 Water contact angle image of IP-DAP$_x$-BA$_y$-WPU films

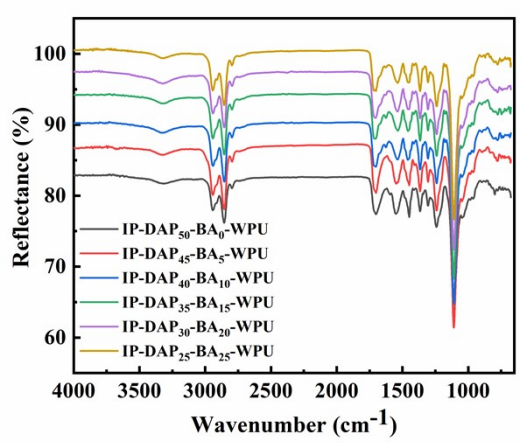

Fig. S2 FTIR spectra of IP-DAP$_x$-BA$_y$-WPU films in the in the frequency range 650–4000 cm^{-1}.

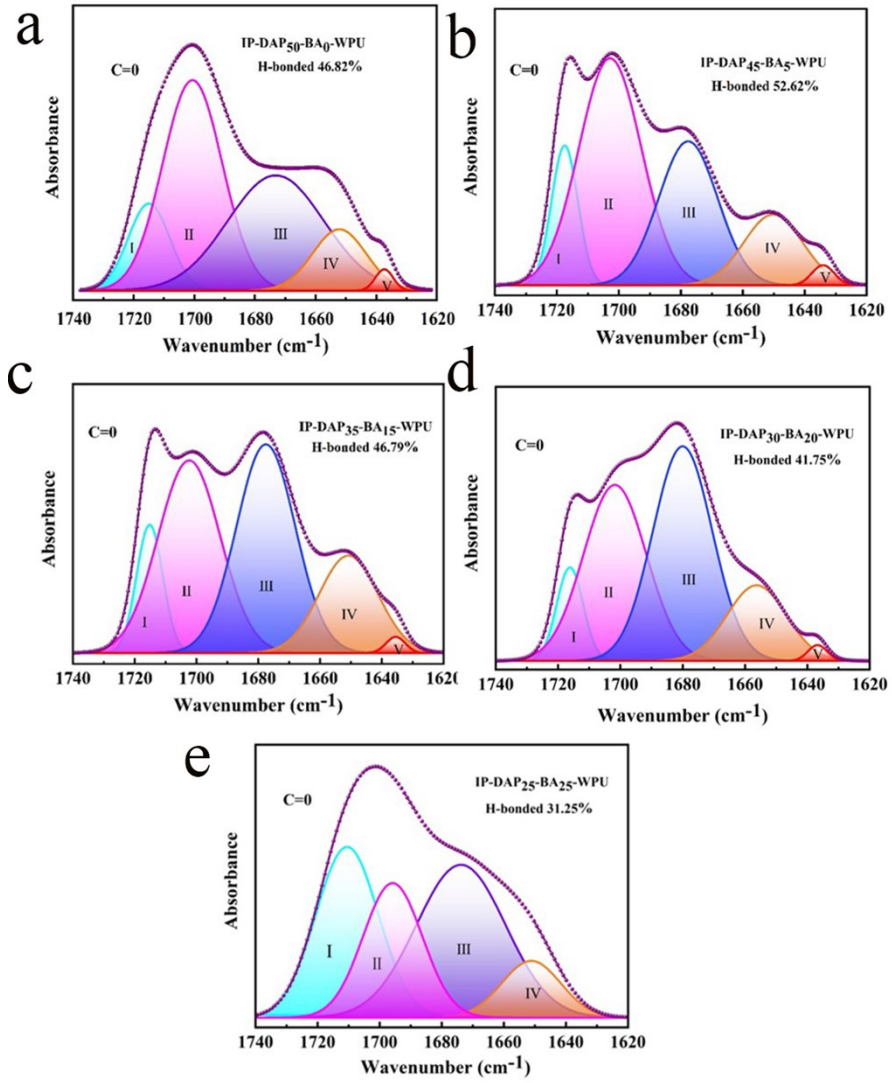

Fig. S3 FTIR spectra of IP-DAP$_x$-BA$_y$-WPU films in the C= O stretching vibration region.

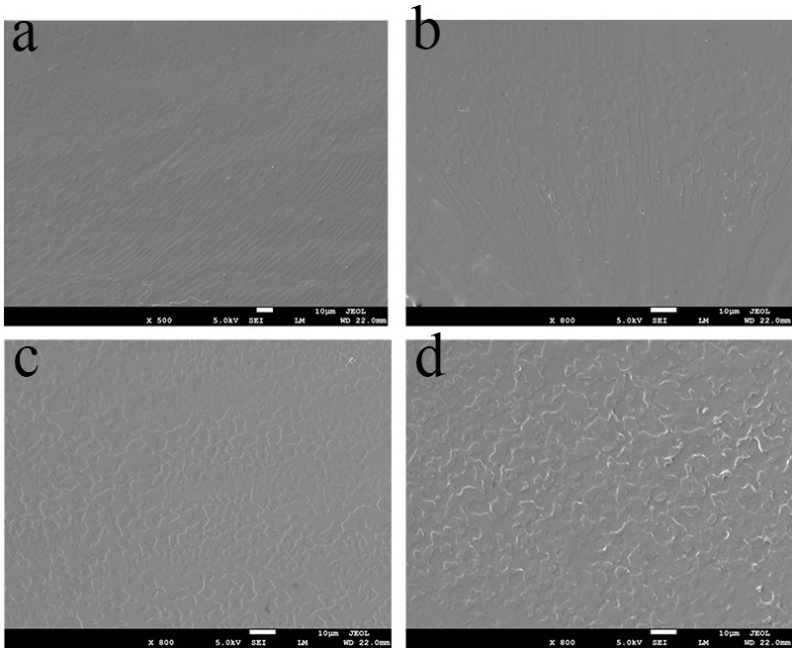

Fig. S4 Representative SEM images at 800× magnifications of the fracture surface of IP-DAP_{50}-BA_0-WPU, IP-DAP_{40}-BA_0-WPU, IP-DAP_{30}-BA_{20}-WPU and IP-DAP_{25}-BA_{25}-WPU films, respectively.

Table S2 Summary of mechanical properties of IP-DAP_x-BA_y-WPU films

Samples	Tensile strength (MPa)	Elongation at break (%)	Toughness (MJ m^{-3})
IP-DAP_{50}-BA_0-WPU	18.92±0.92	898.16±46.32	54.82±1.93
IP-DAP_{45}-BA_5-WPU	22.49±1.38	865.30±33.09	70.51±2.39
IP-DAP_{40}-BA_{10}-WPU	23.88±0.69	857.98±26.88	73.91±1.29
IP-DAP_{35}-BA_{15}-WPU	25.41±2.06	897.48±39.84	85.15±4.21
IP-DAP_{30}-BA_{20}-WPU	30.78±1.56	930.12±48.54	92.74±2.42
IP-DAP_{25}-BA_{25}-WPU	23.77±1.48	985.24±62.73	76.82±2.84
IP-DAP_0-BA_{50}-WPU	13.68±1.07	585.36±49.88	36.92±1.96

In our study, when using pure boric acid, there were many film-forming defects in the IP-DAP_0-BA_{50}-WPU, which performed poor mechanical properties and poor self-healing ability.

Table S3 Summary of mechanical properties of IP-DAP_x-BA_y-WPU films healed at

Samples	Tensile strength (MPa)	Healing Efficiency (%)	Elongation at break (%)	Healing Efficiency (%)
IP-DAP_{50}-BA_0-WPU	7.32±0.32	38.61	285.39±26.32	31.72
IP-DAP_{45}-BA_5-WPU	13.68±0.68	60.82	741.90±36.09	85.73
IP-DAP_{40}-BA_{10}-WPU	21.26±0.93	89.07	679.52±42.06	79.20
IP-DAP_{35}-BA_{15}-WPU	18.38±1.06	72.33	627.67±49.86	69.85
IP-DAP_{30}-BA_{20}-WPU	17.34±1.36	56.33	627.76±48.54	67.47
IP-DAP_{25}-BA_{25}-WPU	8.73±0.85	36.74	422.70±32.73	55.12

80 ℃ for 40 h without water

Table S4 Summary of mechanical properties of IP-DAP_x-BA_y-WPU films healed at

Samples	Tensile strength (MPa)	Healing efficiency (%)	Elongation at break (%)	Healing efficiency (%)
IP-DAP_{50}-BA_0-WPU	7.53±0.39	39.82	268.24±19.36	29.83
IP-DAP_{45}-BA_5-WPU	15.42±0.96	68.56	823.36±46.04	95.15
IP-DAP_{40}-BA_{10}-WPU	21.67±0.86	90.74	787.29±41.85	91.29
IP-DAP_{35}-BA_{15}-WPU	19.40±1.66	76.34	603.62±52.86	67.18
IP-DAP_{30}-BA_{20}-WPU	18.22±1.88	59.19	609.52±58.74	65.52
IP-DAP_{25}-BA_{25}-WPU	9.45±0.77	39.77	485.78±29.73	49.30

80 ℃ for 36 h with water